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NAVAL WARS OF THE FUTURE.

[*Concluded.*]

THE French have been but little behind their island neighbors in building armored ships and making heavy guns, while their classification of vessels has been almost as erratic. Should a British and a French fleet engage each other, it would require a good deal of consideration to dispose them in such a manner that their fighting power would have the greatest effect. Some authorities consider that the French navy is built and armed in better proportion than the British, but that can only be determined by actual experience.

For its size, the Italian navy is perhaps the best arranged of any in Europe. It first class armor-clads, the "Duilio," "Italia," "Lepanto," "Dandolo," "Ruggiero de Lauria" and "Andrea Doria," are marvels of construction and exceed in size the vessels of other navies. These may be truly called ships-of-the-line, and the only objection to them is that they are too large for prompt handling, and it is like carrying too many eggs in one basket; the fighting power had better be in a smaller and more compact form.

Russia has a navy which stands third in numbers and effectiveness, and is modeled after those of Great Britain and France. It is supposed to be equal to the defense of the Baltic, backed by the forts at Cronstadt. All the other European powers have small navies which would help swell the aggregate if Europe should become involved in war. Of these the fleet of Germany is the most important. Either of these navies, supplemented by torpedo boats, would be formidable.

The commanders-in-chief of opposing fleets about to engage in battle could hardly help feeling anxious, for now would come a practical trial of new devices, from the seventeen-inch gun to the mitraïlleuse, which latter may sometimes be a most important weapon and again entirely useless. Of all the torpedoes that have been devised, the Whitehead is generally considered the best, but, although thousands of these weapons have been purchased by the powers of the world, their use in future wars is doubtful. The experiments made by the British Government prove that the auto-mobile torpedo can be disposed of by steel nets hung about a ship's hull, and they are so easily deflected from their course that they cannot be sent against an enemy with any certainty. In its present stage of development the torpedo can hardly be considered a very dangerous weapon—it has not proved itself so in wars of the past.

Here, then, is an element of warfare of which professional men predicted the most important results, which will have to give way to something better, viz.: the American torpedo, now under advisement, which will probably make a great change in future naval operations.

Then there is the ram, with which most of the sea fights of the ancient Greeks were won. All foreign navies have vessels fitted as rams, which are expected to perform great service in time of war. The "ram" is simply an elongation of the bow under water, and although no doubt a vessel so fitted would inflict great injury on an enemy by running into her, she would be liable to injure herself quite as much, and go to the bottom with her foe. No modern rams have been tried in war, and ships so constructed will most likely be failures. In proof of this, take the case of the armor-clad frigate "König Wilhelm," of the German navy, which, in 1878, by bad management, struck the "Grosser Kurfurst" in the side and under water. The latter ship was sunk, and the former so damaged that she had great difficulty in getting into port. The sinking of the British armor-clad "Vanguard" by the "Iron Duke" is another case in point. Thus another element must be eliminated from the calculations of those who have depended on "König Wilhelms" to ram the enemy's ships in time of battle. And so it will be in many cases with the untried weapons with which we must go to war, and the result will be surprise and disappointment.

Such ideas do not seem to have troubled European naval architects, nor to have influenced those on this side of the Atlantic who are attempting to follow in their footsteps, and who generally adopt what Great Britain and France have long since discarded.

I have endeavored, as briefly as possible, to state the general condition of European navies, and will now suppose a case when war has actually occurred.

The navies of Great Britain and France are nearer equal than any other two nations, and while the former has exerted great energy and skill in pushing her navy ahead, France has not been behind hand. Though all French armor-clads cannot be considered in the light of ships-of-the-line, they will be useful in battle from the heavy guns they carry.

In the battle of Mobile Bay, it will be remembered that the small monitors with heavy guns surrounded the huge "Tennessee," and almost smothered her with their rapid fire. As I have before remarked, it may not be well to put too many eggs in one basket; or, in other words, not to have too great confidence in very large ships. Two ships of our "Puritan" class, costing, for both, two millions of dollars, are better than one of the "Agincourt" or "Minotaur" class, which would cost about the same amount.

Let us assume that, in the year 1894, war has been declared between Great Britain and France, and the dock-yards and arsenals of both are busy with preparations for the conflict. To listen to the remarks of the populace one would not suppose that for more than three-quarters of a century the two countries had gone hand in hand in the march of civilization, and had barred the way of the Russian bear to the plains of Constantinople. France is preparing to carry out the policy of the great Napoleon, by the invasion of England, a more feasible undertaking than when sailing vessels had to be depended on to carry troops and munitions of war. At Havre a camp of eighty thousand soldiers is forming; at Calais, fifty thousand men are encamped, ready to be transported to Dover, whence they will march upon London; forty thousand more troops are at Dieppe, ready to land near Yarmouth, while another select corps of equal size is to be landed at such point as occasion may require. For the transportation of all these troops great numbers of sailing transports are provided which are to be towed by the steamers. Scows are provided for the purpose of landing horses and artillery and pontoon bridges to cross any river in England. Nothing is left undone to make the invasion a success—the "Invincible Armada" could not compare with it.

To carry all these troops and their horses and artillery, and tow the transports, are one hundred and thirty-five steamers of the

Messageries Maritimes and other commercial companies, and three hundred and thirty-three others, in all four hundred and sixty-eight steamers of seven hundred and forty-five thousand six hundred and sixty tons displacement. A part of this flotilla is sufficient to transport the two hundred and ten thousand troops to be embarked for the first landing, while the rest of the steamers and sailing vessels are to be kept in reserve for reinforcements. The steam mercantile marine of France, although not comparable to that of Great Britain, is a powerful adjunct in time of war. To insure the support of their whole naval force the French government has directed the ships at Toulon to assemble at Cherbourg and Brest.

These preparations for the invasion of England are based on the supposition that the French armored fleet is superior to that of Great Britain, the French, forgetting that British journalists are great grumblers who cry down their own navy in time of peace, have been misled by such representations instead of being guided by their own observations. They seem also to have forgotten in the lapse of years the numerous victories the English have gained over them upon the sea. The Frenchmen argue, "We are now on a par with our old enemy; this is a military movement, ships and troops being managed by military tactics—the French will beat the English at that kind of fighting where science counts for more than brute force."

Let us assume that all the arrangements are made for a French invasion of England, while English travelers look on with dismay at the prospect of being kept for years out of Paris, and all England is in a panic, for the English are always frightened when the invasion of their country is threatened, and have been so since the time of William of Normandy. They forget when the project is mentioned what British hearts and hands have done in the past to protect their island, and do not think of what they can do in the future with the weapons now at their disposal. The preparations for invasion are known in London as soon as they are fairly under way in France, and while the people tremble at the danger impending, the military and naval authorities devote all their energies to meet the coming storm.

The regular troops, enrolled volunteers and militia, are ordered into immediate service, and stationed at points on the coast where an invading army will be likely to land. These forces number four hundred and fifty thousand men, the larger portion of whom are stationed between Yarmouth and Portsmouth, and an especially large body at Dover, where it is expected the French will attempt to disembark and march upon London. The Channel Squadron occupies the English Channel as far as the Straits of Dover, and has been reinforced by twenty-five frigates, thirty sloops and twenty swift dispatch vessels. Some of the latter are employed constantly in running past the French ports to ascertain the force of vessels, and to note any changes that may occur.

Frigates, sloops and dispatch vessels are stationed all the way from Land's End along the West coast of Ireland, so that a complete system of communication is kept up from Cape Clear to Yarmouth by vessels as well as by inland telegraph and cable. The declaration of war against England by France is much regretted by most of the States of Europe, for it is generally considered that the difficulties could have been settled by arbitration, and now after some years of peace the world is about to witness the result of that science which has been so liberally applied to navies since the time when the "Monitor" and "Merrimac" gave the world to understand that the day of wooden ships was over.

The contending naval forces to form the lines of battle are as follows:

ENGLAND.

Turret Ships.

8 Inflexible, 4 16-in., 4 4-in.
4 Dreadnaught, 4 12½-in.
4 Devastation, 4 12-in.
4 Thunderer, 2 12-in., 2 12½-in.
9 Colossus, 4 12-in. (B. L.), 5 6-in.
9 Edinburgh, 4 12-in., 5 6-in.

Barbette Ships.

10 Collingwood, 4 12-in., 6 6-in.
10 Rodney, 4 13½-in., 6 6-in.
10 Howe, 4 13½-in., 6 6-in.
10 Camperdown, 4 13½-in., 6 6-in.
12 Benbow, 2 17-in., 10 6-in.
10 Anson, 4 13½-in., 6 6-in.

Second Class.

Turret Ships.

6 Agamemnon, 4 12½-in., 2 6-in.
6 Ajax, 4 12½-in., 2 6-in.
6 Conqueror, 2 12-in., 4 6-in.
6 Hero, 2 12-in., 4 6-in.
4 Rupert, 2 9.2-in., 2 6-in,
2 Hotspur, 2 12-in.
2 Glatton, 2 12-in.

Corvettes.

4 Belleisle, 4 12-in.
4 Orion, 4 12-in.

Third Class.

Rigged Ships.

12 Superb, 8 10-in., 4 9-in.
6 Neptune (turret), 4 12½-in., 2 9-in.
7 Monarch (turret), 4 12-in., 2 9-in., 1 7-in.
14 Hercules, 8 10-in., 2·9-in., 4 7-in.
19 Sultan, 8 9.2-in., 4 8-in., 7 4-in.
12 Alexandra, 10 10-in., 2 11-in.
8 Temeraire, 4 11-in., 4 10-in.
12 Nelson, 4 10-in., 8 9-in.
12 Northampton, 4 10-in., 8 9-in.
9 Shannon, 2 10-in., 7 9-in.
15 Bellerophon, 10 9-in., 5 7-in.
11 Penelope, 8 8-in., 3 40-pdrs.
10 Imperieuse (Bar), 4 9.2-in., 6 6-in.
10 Warspite, 4 9.2-in., 6 6-in.
18 Audacious, 10 9-in., 8 4-in.
14 Iron Duke, 10 9-in., 4 64-pdrs.
14 Invincible, 10·9-in., 4 64-pdrs.
18 Swiftsure, 10 9-in., 8 4-in.
18 Triumph, 10 9-in., 8 4-in.

Fourth Class.

Turret Ships.

4 Cyclops, 4 10-in.
4 Gorgon, 4 10-in.
4 Hecate, 4 10-in.
4 Hydra, 4 10-in.
4 Prince Albert, 4 9-in.
4 Scorpion, 4 9-in.
4 Wyvern, 4 9-in.

Gun-boats.

4 Viper, 2 7-in., 2 24-pdrs.
4 Vixen, 2 7-in., 2 24-pdrs.
4 Waterwitch, 2 7-in., 2 24-pdrs.

Fifth Class.

Rigged Ships.

32 Warrior, 4 8-in., 28 7-in.
32 Black Prince, 4 8-in., 24 7-in.
16 Achilles, 14 9-in., 2 7-in.
17 Minotaur, 17 9-in.
17 Agincourt, 17 9-in.
26 Northumberland, 6 9-in., 18 8-in., 2 6-in.
18 Hector, 2 8-in., 16 7-in.
18 Valiant, 2 8-in., 16 7-in.
16 Defence, 2 8-in., 14 7-in.
16 Resistance, 2 8-in., 14 7-in.
18 Lord Warden, 14 8-in., 2 9-in., 2 7-in.
12 Repulse, 12 8-in.

FRANCE.

Cuirassés, 1st rang.

14 Devastation, 4 13½-in., 4 10⅝-in., 6 5½-in.
14 Foudroyant, 4 13½-in., 4 10⅝-in., 6 5½-in.
18 Amiral Duperré, 4 13½-in., 14 5½-in.
6 Caiman, 2 16½-in., 4 4-in.
6 Indomptable, 2 16½-in., 4 4-in.
6 Tonnerre, 2 10⅝-in., 4 4¾-in.
6 Fulminante, 2 10⅝-in., 4 4-in.
2 Furieux, 2 13½-in.
14 Redoutable, 8 10⅝-in., 6 5½-in.
16 Trident, 8 10⅝-in., 2 9½-in., 6 5½-in.
16 Friedland, 8 10⅝-in., 8 5½-in.
16 Colbert, 8 10⅝-in., 2 9½-in., 6 5½-in.
15 Marengo, 4 10⅝-in., 4 9½-in., 7 5½-in.
11 Océan, 4 10⅝-in., 4 9½-in., 2 5½ in., 1 4¾-in.
15 Suffren, 4 10⅝-in., 4 9½-in., 6 5½-in., 1 4¾-in.
13 Flandre, 8 9½-in., 5 7½-in.
12 Gauloise, 8 9½-in., 4 7½-in.
19 Richelieu, 6 10⅝-in., 5 9½-in., 7 5½-in., 1 4¾-in.
13 Heroine, 8 9½-in., 3 7½-in., 2 5½-in.
16 Provence, 8 9½-in., 3 7½-in., 2 5½-in., 3 4¾-in.
16 Revanche, 8 9½-in., 3 7½-in., 2 5½-in., 3 4¾-in.
15 Savoie, 8 9½-in., 3 7½-in., 4 5½-in.
16 Surveillante, 8 9½-in., 4 7½-in., 4 5½-in.
16 Valeureuse, 8 9½-in., 1 7½-in., 6 6.3-in., 1 4¾-in.
12 Couronne, 8 9½-in., 4 7½-in.
15 Formidable, 3 17-in., 12 5½-in.
6 Terrible, 2 16½-in., 4 4-in.
6 Requin, 2 16½-in., 4 4-in.
15 Amiral Baudin, 3 16½-in., 12 5½-in.
24 Hoche, 2 13½-in., 2 10⅝-in., 20 5½-in.
24 Magenta, 2 13½-in., 2 10⅝-in., 20 5½-in.
24 Marceau, 2 13½-in., 2 10⅝-in., 20 5½-in.
24 Neptune, 2 13½-in., 2 10⅝-in., 20 5½-in.
6 Charles Martel, 4 13.4-in., 2 10⅝-in.
20 Brennus, 4 13.4-in., 8 9½-in., 8 5½-in.

Cuirassés, 2d rang.

2 Tempéte, 2 10⅝-in.
2 Vengeur, 2 13½-in.
2 Tonnant, 2 13½-in.
12 La Galissonnière, 6 9½-in., 6 3⅝-in.
14 Triumphante, 6 9½-in., 1 7½-in., 6 5½-in., 1 4¾-in.
13 Victorieuse, 6 9½-in., 1 7½-in., 6 5½-in.
10 Alma, 6 7½-in., 4 4¾-in.
12 Atlante, 6 7½-in., 6 4¾-in.
12 Belliqueuse, 4 7½-in., 4 6.3-in., 4 5½-in.
10 Jeanne d'Arc, 6 7½-in., 4 4⅝-in.
12 Montcalm, 6 7½-in., 6 3⅝-in.
12 Reine Blanche, 6 7½-in., 6 4-in.
12 Thétis, 6 7½-in., 6 3⅝-in.
12 Bayard, 4 9½-in., 2 7½-in., 6 5½-in.
12 Duguesclin, 4 9½-in., 1 7½-in., 6 5½-in., 1 4¾-in.
10 Turenne, 4 9½-in., 2 7½-in., 4 5½-in.
12 Vauban, 4 9½-in., 1 7½-in., 6 5½-in., 1 4¾-in.
12 Acheron, Cocyte, Phlegeton and Styx, building, to be armed with 1 10¾-in. and 2 4-in. guns each.
4 Fussée, Grenade, Mitraille and Flamme, building, to be armed with 1 9½-in. gun each.

Garde-cotes Cuirassés.

2 Cerbére, 2 9½-in.
2 Tigre, 2 9½-in.
2 Bélier, 2 9½-in.
2 Boule-dogue, 2 9½-in.
1 Tareau, 1 9½-in.

Totals.

England	647 guns.
France	683 guns.

To the British fleet is added a reserve of forty frigates, twenty sloops of war and thirty dispatch vessels, the latter of great speed. Fifteen of the largest and swiftest merchant steamships armed with smooth bore and each carrying two eight-inch guns, and forty large steamers carrying coal and munitions of war. Attached to the British fleet are eight large troop-ships of the "Crocodile" class, to be used for a particular purpose in the battle between the contending squadrons. This is a large force requiring great ability to direct.

On October 20th the English fleet puts to sea reporting to the Commander-in-Chief of the Channel Squadron, and are assigned to stations under twelve rear admirals. It now remains to be seen whether the French or the English build the best ships, or whether the ships of either are suitable for war purposes, which have the best guns and which the best system of tactics.

The British Admiral forms his fleet in line of battle off Portsmouth and cruises between that point and Dover, when his lookout vessels report the French fleet standing out of Brest and Cherbourg, accompanied by thirty frigates, twenty dispatch vessels and a number of torpedo boats of different sizes. Three cheers go up from the British fleet and the signal is given, "Form in open order in line ahead!" while the dispatch vessels are ordered to observe night and day and report events in the Straits of Dover.

At this moment the strength of the opposing forces is as follows: British, 62 battle ships, 647 guns; French, 59 battle ships, 683 guns, the British outnumbering their enemy by three ships, while the number of guns and weight of metal are on the side of the French.

The transports carrying the French troops have not yet left harbor, and it is intended they shall do so only when victory is assured the French fleet, then they are to sally out and land at some fixed point in the British Islands, unknown to any one except the French naval authorities.

The night of October 20th is an anxious one; few in either fleet close their eyes. For many years no great battle has been fought upon the ocean, and this one will decide whether all the naval powers have made vital mistakes, or which has evolved the best system out of the various problems that have been offered for solution, and is therefore to remain the principal naval power.

The 21st of October is ushered in with pleasant weather and a moderate breeze from the north, which is not sufficient to cause the ships to roll more than six degrees. At daylight the French fleet is seen standing toward the British fleet in four lines, distant twelve miles, and making a speed of ten knots. The British Admiral signals: "Prepare to form line of battle; head to the northward in groups of three." The fleet is then lying in order line ahead, and when the signal of execution is hoisted the ships close up in groups of three line abreast, a cable's length apart.

At this moment there are coming from the direction of Portsmouth eight vessels low in the water, with apparently no guns, and running at a speed of twenty knots an hour. Close behind them follow twelve dispatch vessels with platforms projecting over their sterns. The British Admiral has taken his station on board a fast dispatch steamer fitted with masts for signaling. He is accompanied by twelve swift tugs to carry orders through the fleet, for a rule has been adopted that the Commander-in-Chief of a fleet shall observe his command from a vessel not in line of battle in order more easily to direct the movements.

When the French ships are within a distance of four miles signal is made to the twelve small steamers (with platforms on the stern) to form in line ahead between the French and English. At this moment the French Admiral makes signal, "Form in column of twos, speed eight knots." Thus while the English, contrary to custom, await the French attack, the latter stand on as if intending to penetrate the English centre. Neither fleet has what may properly be called *rams*,—both trust to the underwater "snout" which caused the sinking of the "Grosser Kurfurst" and the disabling of the "König Wilhelm." The French remember how Lord Rodney "broke the line" of the French fleet in 1782 and captured the best part of it, and perhaps will try this grand manœuvre upon the English, or at all events bring their antagonists to close quarters, when superiority in guns will give them great advantage.

When the French are within three miles, the small steamers with platforms are signaled to "proceed," and they steer rapidly towards the French, and the French Admiral signals, "Lower the torpedo nets." When within a mile of the French fleet, the steamers turn suddenly and run in a zig-zag course towards the British fleet, at the same time commencing to lay a net made of strong ratlin-stuff, with wire rope at the top and supported by cork buoys painted the color of the water. The French not understanding this manœuvre open on the vessels with four-inch Hotchkiss guns. As soon as the net layers have performed their task and got out of the way, the British open upon the advancing enemy all along the line, and in the confusion on board the French ships, owing to the damage inflicted by the shots, they hardly notice the nets, and continue their course, firing rapidly and enveloped in smoke.

The leading French ships soon find their propellers fouled by the nets and their speed decreasing, the ships in the rear crowd on those ahead and in shearing to avoid collision also foul their propellers. The six headmost ships are thrown into confusion, and signal is made to those astern, "Slow down, obstructions ahead." Now is the time for the English to act. Signal is made from the Admiral's vessel, "Right and left wings close upon the enemy, centre divisions stand fast." With a graceful movement the two wings close in upon the van and centre of the French fleet and rounding-to side by side with the Frenchmen there ensues such a combat as the world never before witnessed.

As the two fleets close with each other the French torpedo boats emerge from both sides of the line, and when within one hundred and fifty yards of the English send their torpedoes rapidly out, but the former have their steel nets down and it is like firing peas at an iceberg. Then the English open on the torpedo boats with their four-pounder Hotchkiss and thirty-six-pounder rapid firing guns, four of the torpedo boats are blown up, others are disabled and the remainder retreat to their ships. The English have refrained from encumbering themselves with this weapon of war, which many costly experiments have demonstrated to be useless. They know that auto-mobile torpedoes cannot pass through their steel nets and are satisfied that their own weapons of the same kind cannot pass through the French nets, so have left them behind in the dockyard.

The French van is now in confusion, the centre is enveloped by the wings of the British fleet and the rear is out of action. The French Admiral makes signal to his rear to advance in single column on the starboard and port side of the English fleet and open their batteries, which is done in good order. At the same moment the English centre forming in two columns line ahead bears down upon the French, the starboard column attacking the rear on the port side, the port column attacking the confused van.

Simultaneously the eight peculiar long, low vessels start off with a speed of twenty-six knots, rasping alongside the outer French ships. An explosion takes place and a huge column of water rises high in air—a French ship staggers under the blow, her crew rush for the boats, in five minutes she has disappeared beneath the water. The next torpedo vessel touches the "Trident." The shock is not so great, but the ship hauls out of action and is attacked by three British frigates of the reserve, which keep up such a cannonade that the Frenchmen cannot stay at their guns, being mowed down by the rapid firing guns of the English. In half an hour the "Trident" surrenders.

By this time the French are maintaining a heavy fire on the torpedo vessels with their six-inch rifles and secondary batteries, but they are proof against that weight of metal and pass on to the iron-clads of the second class, four of which are shattered by their torpedo blows and haul out of action in a sinking condition.*

In time of battle mistakes are liable to occur, and a torpedo vessel, curiously called "Cleveland," in honor of the distinguished man in whose Presidency this class of vessels was first designed, strikes the barbette ship "Collingwood" under the counter, causing her to haul out of action leaking so much that the pumps can hardly keep her afloat. One of the French Admirals remarks: "How stupid of the Englishmen to be hoisted by their own petard."

I here take the opportunity to say that the torpedo boat mentioned is a purely American invention, made to grapple with an enemy's ship and blow a hole in her bottom. This torpedo is fitted with an adjustable bar worked by steam, which is swung under the bottom, moving away nets and other obstructions while going at a speed of twenty knots an hour. The discomfiture of the French ships shows with what effect this vessel operates.

An hour after the two fleets join battle there is a blaze all along the line. Scarcely a breath of wind is blowing, and the smoke hangs in thick clouds over the combatants, obscuring everything. The gunners can only fire at the flash, and cannot tell whether their shots hit the enemy. Who can tell what is going on behind that wall of fire and smoke? What chance is there for tactical manœuvres? It seems to a looker on as if the result will be "the survival of the fittest." Blow after blow falls with the weight of Thor's hammer, yet after four hours of steady fighting neither side seems to be materially injured. The English torpedo boats can no longer operate for fear of injuring their own ships. They remain outside the line awaiting their opportunity. The French torpedo boats have long ago given up the idea of sinking anything, and retire behind the line of frigates, where the Admiral watches anxiously the result of the engagement.

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*In an hour the "Alma," "Belliqueuse," "Jeanne d'Arc" and "Montcalm" are at the bottom.

After the fourth hour the "Rodney" emerges from the smoke lashed to the French ship "Formidable," which with her three seventeen-inch guns has made sad havoc with the "Rodney's" hull. A seventeen-inch shell penetrates her machinery and destroys her motive power. The captain of the "Formidable" considering the "Rodney" as good as captured tows her outside the line where the fight continues and the rapid firing thirty-six-pounders and Hotchkiss guns are brought into play. There is no science displayed—nothing but the brute courage of the combatants. The seventeen-inch guns of the "Formidable" are too much for the thirteen and a half-inch guns of the "Rodney," but the Briton bears his punishment bravely.

The line of battle is now extended a length of four miles; those in the rear have little idea of what is going on in the van or centre. Signals cannot be seen, as the atmosphere is everywhere dense with smoke, though the firing is not so incessant as in the beginning. At the end of the fifth hour two tremendous explosions fairly shake the ocean, and the firing on both sides suddenly ceases, it is the silence of calm after a great storm. The smoke clearing gradually away reveals the hulls of the contending ships struggling to release themselves from the debris of battle.

Three British and three French ships lashed to each other recommence hostilities as soon as they can ascertain their position. Those ships still in the smoke do not fire, as they do not know what to fire at. The British Admiral sends out a tug to ascertain the cause of the explosions, and six other tugs to direct the commanders of divisions to get their ships clear of the smoke, and form a new line of battle. At this moment the line of battle is badly disarranged; no one has seen its shape for three hours.

On their return the tugs report that the explosions are from the "Nelson" and "Marengo" blowing up while lashed together, and that several ships on either side are badly damaged. The British

Admiral wonders if he will not lose all his best ships before the battle is over, and anathematizes the man who invented steamships and iron-clads, sighing for the good old days of Rodney and Nelson.

In another half hour the British ships begin to struggle into line to the northward, keeping between their enemy and the coast of France so as to cut off retreat. Oh, what a battered line of battle! The British Admiral is in despair. "My God!" he exclaims, "this will be considered a French victory." The only firing at present is that between the six ships that had paired off, the "Alexandra" with the "Richelieu," the "Iron Duke" with the "Foudroyant," and the "Temeraire" with the "Friedland."

When the French Admiral examines the British ships as they fall into line, "*Mon Dieu!*" he exclaims, "but we have beaten them; we will land in England and the Nile, and Trafalgar will be avenged!" Then, as his own ships come out from the cloud of smoke, "Malheur! I miss six of my ships, and four more are entangled in a net. We shall be fortunate if we return safely to France. Make signal to form in line of battle; we will try steam tactics, this brute force is disgraceful!"

No fleets like these can fight for five hours at close quarters without being considerably damaged, and, suffice it to say, the battle is not renewed. The fleets retire to a respectful distance from each other, including the six belligerents, who have kept up the contest the longest.

Now reports come thick and fast from the chiefs of divisions to the respective commanders-in-chief, and what sad accounts of things there are. "We must land our troops in England," say the Frenchmen, "or lose every vessel!" "Work all night," say the Englishmen, "we will not make so many mistakes to-morrow, we are learning wisdom, these are not the ships with which Nelson fought. The French guns are too much for us; why have not the Admiralty built proper rams, for those are the largest kind of projectiles?"

The reports from both fleets of bursted guns, broken gun-carriages, breech-bolts blown out, boats smashed, turrets jammed, bulwarks broken, spars demolished—beggar description, they can only be appreciated by the profession, yet the death list on either side is not great, and few of the ships are disabled in their machinery. Curved steel decks have, in many instances, deflected the huge shells and saved vessels from destruction, and both British and French officers are satisfied that in the adoption of this device they have made no mistake, and that to make an armorclad invulnerable below the water-line it will be necessary to thicken the curved deck so that magazines and machinery will be out of danger, and a ship with all her guns disabled may still have a chance of escaping. Nothing can destroy her but a properly constructed torpedo boat, and this has made its appearance on the 21st of October, 1894, and has disabled every vessel with which it has come in contact.

The night is spent by the belligerents in repairing damages, especially to the great gun-carriages, which seem to have carried away most of the fastenings, so that the commanding officers of many of the ships may well exclaim, "I have no heavy guns left." Up to and including the six-inch rifles, the gun-carriages stand well, but from that point up, it is generally admitted, the carriages are too weak for the guns. The conclusion arrived at by the officers in either fleet is that the present armor-clads cannot stand the blows of the sixteen and one-half and seventeen-inch rifles any better than wooden ships stood the battering of the forty-two-pounder and eight-inch shell guns, but they are in for it and must fight with the weapons supplied to them.

Here, in the first great battle of recent times, all the lessons taught in the schools of technology are thrown overboard, tactical science ignored and two fleets have entered into a combat in which, like untrained soldiers, they have clubbed each other, with the result that both parties are badly damaged, although both owe it to themselves to keep their vessels in compact form, not to let them foul with their opponents and to decide the contest by methods more worthy well trained scientific officers.

The night after the battle the British and French fleets are lying eight miles apart, repairing damages. The three British forge ships, large steamers fitted with all the appliances of the machine shop, go from ship to ship, to put the gun carriages and machinery in serviceable condition. In this work are engaged over four hundred mechanics, so that by eight o'clock on the morning of the 22d a great deal of the damage had been repaired. No attempt is made to efface the marks of the heavy blows given by the French seventeen-inch shot and shell, which do not much interfere with the fighting qualities of the ships.

But what a sad spectacle to see this mighty fleet, the pride and shield of Britain, so battered and torn!

It is not encouraging to those who have put so much faith in steel hulls, proving to their own satisfaction that the great rifle gun is *king*, and that in action it is only a matter of time when the hull must give way before its crushing and penetrating blows. The French, as badly shattered as the British, are meanwhile doing their best to repair damages, in no wise dispirited by the many fissures in what they had considered their impenetrable ships. It has not often happened to them to lie undisturbed so near a British fleet. It is evident that the new system of warfare places nations nearer an equality.

The night after the battle two large steamers, which have eluded the vigilance of the British lookout ships, join the French fleet. These steamers bring with them forty eight-inch rifled guns prepared for firing melanite shells, together with a large quantity of ammunition. These guns are provided with the latest improved carriages, with steel shields and circles for the guns to work upon. Two hundred expert workmen accompany the guns to put them in place. The two transports run alongside the ships of war, transferring to them their ordnance and stores. This accession causes great rejoicing among the Frenchmen, who now are confident of victory when the attack is renewed, and the French Admiral determines to adopt a system of tactics to confuse the British and enable the French gunners to crush their ships at long range with melanite shells.

The French have been a good deal demoralized by the attacks of the British torpedo vessels, which have inflicted serious loss on their fleet, but as the attacks are not repeated, the French conclude that all the damage has been done, and that the torpedo vessels have been defeated in their plans. The true reason, however, for the torpedo vessels not continuing their attacks is that the British have laid their ships on the outside of the rear of the French, and the torpedo vessels cannot get at the enemy without putting themselves between the fire of the heavy guns of both parties. Both parties are glad to rest from battle, and so they work away repairing damages until eight o'clock of the following morning.

At about that time it is reported to the British Admiral that a fleet of twelve armor-clads are coming through the Straits of

Dover. Later it is reported that the strange squadron is standing towards the French fleet and passing through their line. Later it is reported that the strangers are Germans, and are standing towards the British fleet. This is a great relief to the Admiral, who has run up the signal for battle and for his reserves to close up and cover the fleet.

The German Admiral passes with his squadron all along the line of battle where he sees the battered armor-clads, and cannot repress his astonishment that vessels built with so much strength and at such vast expense should have received so much damage in so short a time. "Ah!" he exclaims, "the gun is king; now we will fire from our Krupp a one thousand eight hundred pound shot capable of penetrating twenty-six inches of steel. Worse than this, Krupp now makes a gun of one hundred and fifty tons, with a shell weighing a ton and a half, having an initial velocity of one thousand nine hundred feet per second, giving a striking force of fifty-seven thousand nine hundred and thirteen foot-tons! What is to become of future fleets?"

The German Admiral steers for the British flagship, runs up the English flag at the fore, and fires a salute of fifteen guns, then he goes on board the British ship.

"Ah! My good Admiral," exclaims the German, "you have fought a great battle, but cannot land your fish, neither can the fish escape. Prince Bismarck sends his compliments together with these vessels. You cannot afford to risk another battle, with the chance of being crippled, for the French will then land where they choose in England. They have still a reserve of fifteen armor-clads fitting out in Cherbourg; you have none. Since the encounter the French have received forty melanite guns."

"Yes," replies the British Admiral, "but I have my eight torpedo vessels, and have already sunk six of their ships and can sink all the rest when once I meet them again in line."

"But the melanite guns will destroy your torpedo boats and then the French will land. Take my advice, let the Frenchmen go into Brest or Cherbourg. They will not be able to get out again for months. You can beat them at repairing, sending in one-third of your vessels at a time."

This is, perhaps, good counsel, but the British Admiral cannot be induced to follow it; he must capture that fleet or perish in the attempt!

"Ah!" continues the German officer, "the true policy is not to get a fleet battered to pieces if you can prevent your enemy from attaining his object when he is in all respects your equal if not your superior. You will accomplish what you aim at, and that is a tactical victory. To invite a battle and, perhaps, defeat, will endanger your island, you cannot afford to risk that."

The German Admiral takes his leave and it seems as if his arguments have more effect on the French Commander-in-Chief, who on the approach of night gets his ships under way and returns to Cherbourg. The British lookout ships follow, but the armor-clads are obliged to remain behind. One of the American-built torpedo vessels evertakes the rear of the French fleet, and running alongside the "Flandre," one of the largest ships, brings her ponderous bar with a hundred-pound gun-cotton torpedo under the enemy's bottom, and in five minutes the "Flandre" is at the bottom of the Channel.

This is the end of hostilities for the time being between the fleets of Great Britain and France, for both parties must repair damages before undertaking further operations. The French are not satisfied that they can successfully operate at sea in face of the British torpedo vessels, and the reserve of fifteen armor-clads is not considered sufficient to enable the fleet to undertake the landing of troops in England under existing circumstances. This engagement between great armor-clads shows that war vessels in 1894 are yet far from perfection.

Our impression of what the future line-of-battle ship should be, will perhaps seem extravagant to those who have been engaged in devising war vessels. The best way, perhaps, to test the question would be to put one of the strongest armored vessels under fire of two seventeen-inch guns for half an hour. The experiment would be worth all it would cost, for it might save many battles in the future.

The commerce-destroyers of to-day are well adapted to their purpose, and in case of war between two maritime nations, the commerce of both would probably be swept from the ocean.

No ship has yet been constructed that would serve the purpose of a *ram*,—that is, could run with great speed into an enemy's vessel and sink her without material damage to herself, or could receive the heaviest shell without being crippled. The fleet that has the swiftest ships, other things being equal, will probably win, for such ships can always choose their position at sea.

The torpedo of the last decade has shown itself to be practically useless. The American torpedo vessel now under advisement, will, no doubt, become a powerful adjunct in time of war, as steel nets will afford no protection against them.

The object of a navy is for the protection of coasts and to make war on an enemy; unless it is equal to both these requirements it is defective. The great gun is the prime factor in war, for it will command not only an enemy's coast but all his seaboard cities. Last, though not least, fleets will be twice as formidable through a perfect system of drill, so that the most complicated manœuvres can be executed on the water the same as by a well drilled army on land. One or two fleets will be sacrificed owing to defects in the system of Naval Tactics, but the time will come when tactics will be perfected and the manœuvring of a fleet will be "a thing of beauty."

Skill in handling large numbers of vessels, in gunnery and managing torpedo vessels, will be essential to excellence in future fleets. In this will be included the use in battle of nets constructed for the purpose of impeding the progress of ships in line, as elsewhere mentioned in this article.

The first step towards the rehabilitation of all the naval powers will be the introduction of a class of vessels of the line that shall be practically unsinkable by shot or shell, and at the same time carry a good supply of the heaviest guns. The gun vessel is the most important in war, for it combines more than any other class, and these ships should be built to possess the greatest speed and endurance, and offer a uniform resistance all along the line of battle, as did the ships of the British navy in the days of old.

Iron has usurped the place of the oaken walls, but as yet it does not appear that the iron ships are *proportionally* as effective considering the change in material of hulls and the greater size of ordnance, as were the ships of the Wellington class.

In the naval wars of the future the United States will not probably play a conspicuous part. This country seems to possess none of that fitness for naval power of which her early history gave promise. The United States government waited twenty years after the close of the civil war before commencing to rehabilitate the navy, on the plea that it was desirable to see what the powers of Europe were going to do, apparently not remembering that the best steam and sailing vessels in the world were the results of American genius in the days when it took the initiative. Americans have abdicated the position which their vast resources entitle them to hold, and have not had the energy to keep their mercantile marine from being driven from the ocean by foreigners, who, as common carriers, take on an average one hundred and fifty millions of dollars out of the country yearly in payment of freights.

Our coasts and seaboard cities are unprotected, and our navy is a by-word even among the Chinese, who, since our Civil War, have seen nothing better than the "Richmond," the "Brooklyn," and such like vessels of the past which are unfit to be sent abroad, yet we could, if we would, soon be equal to the best of European navies in line-of-battle ships and heavy guns, since, as I maintain, there is not one perfect line-of-battle ship in any navy.

As yet the only fair test of the endurance of modern armored ships is the engagement between the fleet under command of Admiral Seymour and the defenses of Alexandria. On that occasion the following British ships took part: Outside squadron, "Alexandra," "Inflexible," "Sultan," "Superb" and "Temeraire."

"Alexandra," 9,480 tons displacement; main deck battery, eight ten-inch rifles; spar deck battery, two twelve-inch, two ten-inch rifles; total, twelve guns.

"Inflexible," 11,880 tons displacement, two sixteen-inch rifles in each turret; total, four guns.

"Sultan," 9,290 tons displacement; in casemate battery, eight ten-inch rifles; in upper deck casemate, four nine-inch rifles; total, twelve guns.

"Superb," 9,170 tons displacement; in casemate, main deck, twelve ten-inch rifles; in bow and stern batteries, four ten-inch rifles; total, sixteen guns.

"Temeraire," 8,547 tons displacement; in casemate, four ten-inch, two eleven-inch rifles; in turrets, two twenty-five-ton guns; total, eight guns.

Inshore squadron: "Invincible" (flagship), "Monarch" and "Penelope."

"Invincible," 6,000 tons displacement; casemate, main deck, six nine-inch rifles; spar deck battery, four nine-inch, four sixty-four-pounder rifles; total, fourteen guns.

"Monarch," 8,320 tons displacement; in turrets, four twelve-inch rifles; in bow, two nine-inch rifles; in stern, one seven-inch rifle; total, seven guns.

"Penelope," 4,470 tons displacement, eight eight-inch rifles, three forty-pounders; total, seven guns.

Five wooden gunboats, composite built: "Bittern," "Condor," "Beacon," "Cygnet," and "Decoy."

"Bittern," 1 7-inch, 2 40-pounders; total, 3 guns.

"Condor," 1 7-inch, 2 64-pounders; total, 3 guns.

"Beacon," 2 64-pounders, 2 20-pounders; total, 4 guns.

"Cygnet," 2 64-pounders, 2 20-pounders; total, 4 guns.

"Decoy," 2 64-pounders, 2 20-pounders; total, 4 guns.

Guns in outside squadron	52
Guns in inshore squadron	28
Guns in gunboats	18
Grand total	98

I think every naval officer will admit that had the old wooden line-of-battle ships of the Trafalgar and Wellington class taken the place of the armor-clads at Alexandria, they would have silenced the forts in an hour with little damage to themselves. The British vessels were not seriously injured, but the perforations of the Egyptian shells showed what trouble would have occurred had they been charged with dynamite. Here is a new element that has not been used in battle, but there is little doubt from experiments made in this country with the Graydon shell against iron turrets, that a new aspect will be given to future wars by the use of this powerful explosive. The value of the Graydon shell has been demonstrated by experiments that should satisfy the most skeptical. Some trials of this projectile conducted by officers of the U. S. Army, show its destructive effects against iron. Perhaps two or three small vessels, each armed with one long-range dynamite shell gun, will soon be able to destroy the largest armor-clad of the present day.

The following is the account of the experiments: "The gun used on this occasion was a seven-inch Ames wrought-iron, muzzle-loading rifle, weighing twenty-three thousand pounds, and the weight of the charge of powder was twenty-three pounds. The projectile was of steel, open at the rear and closed by a bronze plug, the same general form as used in the service; its weight being one hundred and twenty-two pounds and the charge of dynamite exploded being two and two-thirds pounds." . . .

"The first shell struck the target twenty-four inches above the horizontal joint and thirty-three inches to the left of the embrasnre, and, although it was a glancing shot and not a "point on" shot, as was desired to test the penetration, it made an indenture three inches deep, exploding with great violence." . . .

"The roof (of the turret) was lifted off, breaking seven bolts, each one and three-fourths inches in diameter, used to assemble the same, and five bolts three and three-fourths inches in diameter, used to bolt the front and rear plates together. It also made a crack ten inches long in the front plate and about eighteen inches long in the rear plate."

"The wreckage was very marked, in fact, almost complete, the roof alluded to above, which weighed thirty thousand nine hundred pounds, being torn off and blown twenty-five feet to the rear by actual measurement."

"The two seven-inch plates of the turret proper were also torn apart a distance of five inches, breaking off the bolt heads which secured the plates together."

In regard to the Zalinski pneumatic gun I am not prepared to give an opinion, as it has not yet been tried under the difficult circumstances that will attend its use on shipboard. Its insufficient range is calculated to weaken confidence in the invention, but if it does succeed there will be another factor which, although not equal to the Graydon dynamite projectile, will still make its mark in the naval wars of the future.

It may posssibly be that Americans, who at present are so far in the rear in regard to naval matters, will ere long come to the fore with inventions which will give them the superiority, and they may be prepared in a *cheap way* to inflict on an enemy so much damage that it would not be worth while for any one to meddle with us.

The naval wars of the future will most likely be carried on among European powers. The United States will have but a small share in them, since the latter will not be willing to maintain a navy sufficient even to protect their coasts and seaboard cities. They will prefer to do as they did once with the Barbary Powers, pay tribute! Future naval battles will be something to appall the stoutest hearts. Civilization will stand aghast at the awful spectacle, the bottom of the ocean will be strewn with wrecks, mammoth guns and the bodies of men, commerce destroyers will carry ruin and desolation in their wake. The horrible implements of destruction have so multiplied that the results we have indicated cannot be avoided. The only consolation is that the next great war may be so terrible that future conflicts will be less likely to occur, and the world will therefore remain at peace.

DAVID D. PORTER.